

**REMARKS**

In the Office Action dated March 24, 2008, claims 1-13 and 18-29 are pending in the application, claims 5-13 and 18-29 are withdrawn from consideration as being drawn to a non-elected invention, and claim 1-4 stand rejected. Claims 1-4 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. Claims 1 and 4 stand rejected under 35 U.S.C. § 102(a) as anticipated by M. R. Cimberle et al., "Magnetic characterization of sintered  $\text{MgB}_2$  samples: effect of substitution or 'doping' with Li, Al and Si," Superconductor Science and Technology, Vol. 15, 2002, pp. 43-47 (hereinafter "Cimberle et al."). Claims 1 to 4 stand rejected under 35 U.S.C. § 102(a) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over T. He and R. J. Cava, "Reactivity of  $\text{MgB}_2$  with common substrate and electronic materials," Applied Physics Letters, Vol. 80, No. 2, 14 January 2002, pp. 291-293 (hereinafter "He et al.").

Claims 1-3 have been amended and claims 30-34 have been added as new. Support for the amended and new claims can be found at least in paragraphs 0005-0008, 0015-0018, 0032-0035, 0040-0044, and Examples 1 and 2.

The Applicants hereby affirm the provisional election made by Dr. James P. Krueger during a telephone conversation with the Examiner on March 7, 2008 to prosecute Group I, claims 1-4.

***Section 112 Rejection***

Claims 1-4 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. The Applicants have amended claims 1-3 to conform to current U.S. practice and have left claim 4 as it was previously presented. The Applicants believe that the amendments overcome the rejection and respectfully request that this rejection be withdrawn.

*Section 102 Rejection (Cimberle et al.)*

Claims 1 and 4 stand rejected under 35 U.S.C. § 102(a) as anticipated by Cimberle et al. The Applicants respectfully submit that the claims, as presently amended, are not anticipated by Cimberle et al. The amended claims relate to magnesium diboride superconductors doped with silicon carbide and not elemental silicon or carbon. The Applicants submit that doping with silicon carbide is not disclosed, nor is it taught toward, in Cimberle et al. Therefore, the Applicants respectfully request that this rejection be withdrawn.

*Section 102(a), 103(a) Rejection (He et al.)*

Claims 1 to 4 stand rejected under 35 U.S.C. § 102(a) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over He et al.

The Applicants respectfully submit that the proposed new claims are novel and not obvious in light of He et al. The Applicants respectfully submit that He et al. does not disclose or teach one of ordinary skill in the art that magnesium diboride could be doped with silicon carbide to form a superconducting material falling within the scope of the claims of the present application.

He et al. describes the reactivity of magnesium diboride with common substrates and electronic materials. The Applicants point out that He et al. describes experiments to determine the compatibility of magnesium diboride with potential substrate materials for applications in thin-film electronic devices, and has absolutely nothing to do with improvement of critical current density of magnesium diboride superconductors. The Applicants further point out that the purpose of the He et al. paper was to determine whether many common electric and substrate materials can react with magnesium diboride, because such reactions are undesirable for some applications of electronic devices.

In contrast, the present disclosure relates to the discovery that the factors of critical current density, irreversibility field and flux pinning of MgB<sub>2</sub> are significantly improved by

chemical doping with SiC, potentially paving the way for MgB<sub>2</sub> based superconductors to replace the current market leaders NbTi and Ag/Bi2223 (*see* paragraph 0008).

In the magnesium diboride superconducting material claimed in the present application, a specific amount of silicon diboride is doped into the magnesium diboride superconducting material to provide enhanced superconducting properties and improve flux pinning of magnesium diboride superconductors. The Applicants submit that one of ordinary skill in the art would understand that doping is a specific process in which a certain amount of material (*e.g.*, SiC) is added to a host material in order to controllably achieve required properties of the host material. For the reasons discussed below, the Applicants respectfully submit that He et al. simply discloses that a “reaction” occurs between silicon carbide and magnesium diboride, and does not provide an enabling disclosure of doping of magnesium boride with silicon carbide, let alone doping to improve electromagnetic properties.

The Applicants submit that He et al. does not, either inherently or otherwise, disclose or teach towards superconducting materials falling within the scope of the claims of the present invention. Indeed, we submit that He et al. does not even clearly or unmistakably disclose that silicon carbide is incorporated into magnesium diboride under the reaction conditions described in He et al. In Table 1 (page 291), it is disclosed that when silicon carbide, magnesium and boron are heated to 800°C “MgB<sub>2</sub> with altered cell size” is formed. The Applicants submit that the “altered cell size” could be understood to mean:

- (1) that a “foreign” species has been incorporated in the magnesium diboride crystal lattice. That species could, for example, be C, Si, SiC or any other species released or formed due to secondary reactions enabled by the presence of MgB<sub>2</sub> and SiC (*e.g.*, oxygen, which is very reactive with magnesium); or
- (2) that the change in formula has occurred with incorporation of a foreign species into the magnesium diboride crystal lattice. For example, if some magnesium was consumed from the MgB<sub>2</sub>, then it could lead to a deficiency of Mg, implying a new formula Mg<sub>1-x</sub>B<sub>2</sub>, which could have a

different crystal lattice and correspondingly different XRD peaks to  $\text{MgB}_2$ .

The Applicants submit that these possibilities were not described by He et al., because that was not the purpose of the He et al. paper. He et al. simply referred to “altered cell size” as evidence that some sort of chemical reaction has occurred which altered the cell size of the magnesium diboride.

The Applicants further note that in the Examples set out in the specification for the present application, temperatures of higher than  $800^\circ\text{C}$  for significantly less than 24 hours in an atmosphere containing no  $\text{H}_2$  are used to form the exemplified superconducting materials. The Applicants respectfully submit that it is not appropriate for the Examiner to contend that superconducting materials falling within the scope of the present disclosure are inherently disclosed in He et al. given the different experimental conditions (*e.g.*, different temperatures, different reaction durations, and different atmospheres) and lack of specific results provided by He et al.

Moreover, the Applicants submit that He et al. in no way describes or teaches the specific formula of the superconducting material of the present disclosure. The Applicants submit that He et al. does not disclose or teach toward the effect of SiC in critical current density and upper critical field of the resultant “ $\text{MgB}_2$  with altered cell size” product. On the contrary, the Applicants submit that He et al. teaches away from the combining magnesium diboride and silicon carbide by indicating that these species are “chemically incompatible” (page 292). The Applicants submit that this conclusion further highlights the vast differences between the disclosure and teachings of He et al., and the purpose of the subject of the present application.

For the above reasons, the Applicants respectfully submit that amended claims 1-4 are novel and not obvious over He et al. and request that the rejection be withdrawn.

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AMENDMENT dated July 24, 2008  
Reply to Office Action of March 24, 2008

*Conclusion*

For all of the reasons listed above, the Applicants respectfully request reconsideration and allowance of claims 1-4 and entry of new claims 30-34. The Examiner is invited to contact the undersigned attorney to expedite prosecution.

The Commissioner is hereby authorized to charge any additional fees which may be required with respect to this communication, or credit any overpayment, to Deposit Account No. 06-1135.

Respectfully submitted,  
FITCH, EVEN, TABIN & FLANNERY

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